CENTRAL INTELLIGENCE AGENCY

C-O-N-F-I-D-E-N-T-I-A-L

50X1-HUM
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COUNTRY North Korea

SUBJECT The Changjin-gang Hydroelectric Power Plant

REPORT

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Summary. The Changjin-gang Hydroelectric Power Plant in Hamgyŏng-namdo, originally consisting of four power plants, was severely damaged during the Korean War. 50X1-HUM with Czechoslovakian assistance, the entire plant was reconstructed. Average capacity of the plant rose from 80,000 kva to 330,000-350,000 kva 50X1-HUM However, most of the plant's equipment was old, operated inefficiently, and caused frequent trouble and accidents. Security of the plant included armed guards, barbed wire fences, charged wiring, and flood lights. Plant inspections were conducted by the Korean Labor Party's Central Committee, and officials of other power plants, along with those of the plant's own management.

Background

1. The Changjin-gang Hydroelectric Power Plant in Hamgyŏng-namdo, roughly 40 miles northwest of Hŭngnam, originally consisted of two reservoirs, one pumping station, and four power stations which were located along the eastern slopes of the mountains.[1] Water was conducted through pressure tunnels to the forebay of Power Station No. 1 which, in turn, supplied exhaust water

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GROUP 1
Excluded from automatic downgrading and declassification

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(Note: Field distribution indicated by "#".)

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to the other station and then to the next. When it was fully operative, the total capacity of the plant was as follows:

Power Stations	Generators No. 1, 2, & 3	Generator No. 4	Total
Station No. 1	40,000 kva each	40,000 kva	160,000 kva
Station No. 2	31,111 kva each	31,111 kva	124,444 kva
Station No. 3	15,500 kva each	----------	46,500 kva
Station No. 4	13,500 kva each	----------	40,500 kva
Total			371,444 kva

2. After the liberation, facilities of the Changjin-gang Power Plant were kept intact, but operation was limited because the demand for power in North Korea was low. However, output gradually rose as the demand for power increased, and, [redacted] reached about 80 percent of its capacity. 50X1-HUM
Most of the plant's installations were totally damaged during the Korean War, although some valuable machines such as generators, transformers, and turbines had been dismantled and moved to safety in nearby mountain valleys. Reconstruction of Power Station No. 1 was started [redacted] even before 50X1-HUM
the end of the war, with arched ceilings of ferro-concrete about three meters thick being constructed above generators No. 3 and No. 4 as a protective measure. The generators were operative [redacted]. In 50X1-HUM
order to facilitate further reconstruction, the Fourth Construction Trust was organized under the then Ministry of Electricity and was made responsible for the reconstruction of the plant, [redacted] generator 50X1-HUM
No. 4 of Power Station No. 2 had been put into operation.

Plant Reconstruction

3. Reconstruction of the plant was facilitated by Czechoslovakian material and technical aid [redacted] 50X1-HUM
approximately 50 Czechoslovakian technicians and skilled workers helped reconstruct the plant. The following machines and materials came from Czechoslovakia: coils for six generators, two exciters, seven 21,000-kva transformers, three 32,000-kva transformers, one 60,000-kva transformer, two 630-kva transformers, two 530-kva transformers, control board equipment for three power stations (Power Stations Nos. 1, 2, and 4), 11 automatic voltage regulators, eight turbine governors, expansion circuit breakers for a total of 48 phases, about 130 disconnecting switches, approximately 80 percent of the secondary-circuit lead-covered cables required for 50X1-HUM
the reconstruction, and 120 meters of penstock pipes for Power Station No. 1. While the North Korean government had originally expected Czechoslovakian aid to be gratis, as in the case of aid from the USSR and Communist China, it was later learned that all Czechoslovakian aid had to be paid for and that the price of the machines, [redacted] was approximately 30 percent higher than on the international 50X1-HUM
market. In addition, the North Korean government had to pay monthly salaries and daily food allowances to the Czechoslovakian workers. As a result of Czechoslovakian aid, a total of 11 generators were reconstructed [redacted] when reconstruction of 50X1-HUM
the entire plant was completed.

4. Reconstruction was initially expected to restore the plant to its original state, but because of the use of Czechoslovakian machines and parts, some of the structures were altered. In particular, the transformer and transmission facilities of Power Station No. 2 were remodelled to form the

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center of the power distribution system in North Korea, i.e., Power Station No. 2 became a connecting point of all transmission lines in the country. approximately 100,000 kilowatt hours generated in the eastern part of North Korea were transmitted to the western part by the transformer and transmission facilities of this power station. In addition, four dams were newly constructed : (a) at Kot'o-ri, Changjin-gun, Hamgyŏng-namdo, (b) at approximately 500 meters northwest of Power Station No. 1, (c) at approximately 400 meters northwest of Power Station No. 2, and (d) at approximately 300 meters east of Power Station No. 3. These dams were constructed in order to harness the Kot'osu and the Hŭngnim-ch'ŏn rivers for additional water for the Changjin-gang Power Plant. The midway water intake facilities were constructed Power Station No. 5, with a generating capacity of 8,000 kva and designed to use exhaust water from Power Station No. 4, The construction work was done by the Fourth Construction Trust of the Power Industry Management Bureau (PIMB), Heavy Industry Commission; the assembling of equipment was done by the Eighth Construction Trust of the PIMB. All of the machines and equipment installed at Power Station No. 5 were produced by North Korean factories: transformers and generators, including two 4,000-kva generators, by the Taean Electric Appliances Factory in Yonggang-gun, P'yŏngan-namdo; turbines by the Yongsŏng Machine Factory in Hamhŭng-si, Hamgyŏng-namdo; control boards by the P'yŏngyang Electric Factory in P'yŏngyang; and switches by Chuŭl Electric Factory in Kyŏngsŏng-gun, Hamgyŏng-pukto.

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Output

5. The output of the Changjin-gang Power Plant, which steadily increased showed a sharp drop because of a severe drought, so that each of the four power stations operated only two generators. One of the two generators operated merely as a synchronous condenser. The total capacity of the power plant dropped to 120,000 kva 80,000 kva . However, with the rainfall in the summer power production rose again. The following are average capacity figures:

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	80,000 kva
	100,000 kva
	150,000 kva
	220,000 kva
	120,000 kva
	330,000 - 350,000 kva
	330,000 - 350,000 kva
	330,000 - 350,000 kva

6. While the generator buildings of the Changjin-gang Power Plant were originally designed to accommodate five generators each at Power Stations No. 1 and No. 2, and four each at Power Stations No. 3 and No. 4, the capacity of the waterway was inadequate for this number of generators. Since it was not feasible to develop additional sources of water after the construction of Power Station No. 5, further expansion of generating capacity was not planned

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Condition of Equipment

7. Except for new equipment replaced during the period of post-war reconstruction, most of the plant's equipment had been in use 50X1-HUM
Coils of generator No. 1 of Power Station No. 1 and of the four generators of Power Station No. 2 had been replaced with new ones, and Power Station No. 1 was equipped with spare coils for one generator. Coils of the other generators were all old and had been in use 50X1-HUM
As a result, the pressure test of those coils were conducted for a minute at 1.2 times that of the rated voltage. The overvoltage relays were set at 120 percent and 0.3 seconds, in order to prevent overvoltage accidents of the generators. The unguarded section was reduced to 10 percent by making use of ferrous hydrogen lamps and the rated phase voltage was lowered as low as one-eleventh, in order to prevent grounding accidents within the generator. Turbines were repaired with spare parts stocked 50X1-HUM
and their efficiency ranged from 81 to 85 percent. However, as a result of the sand influx caused by damage of water intake towers and the mid-way intake facilities, the efficiency of the turbines began to deteriorate rapidly 50X1-HUM
Because of the increasing demand for power, the generators were often overloaded as much as 10 percent, with coil temperatures rising to 90 degrees centigrade, so that generator coils wore out within 10 years. 50X1-HUM
the 3.3 kva power distribution equipment of Power Station No. 1 and three 500-kva transformers for the Changp'ung transmission line of Power Station No. 4 were extremely worn and caused frequent trouble, but they could not be replaced because the equipment was in short supply. In an effort to maintain the generating equipment, minor repairs were carried out once a month and major repairs, such as overhaul of generators and turbines, once every two years. About 10 accidents occurred as a result of mismanagement of machines 50X1-HUM
In addition, four accidents occurred as a result of flashover of Czechoslovakian insulators, one resulted from poor insulation of a Czechoslovakian transformer, five resulted from poor insulation of old transformer coils.

Security 50X1-HUM

8. The security department of the power plant, which was probably an element of the Hamgyong-namdo Internal Affairs Department, consisted of approximately 80 internal affairs personnel, but their names as well as the organizational structure of the department were unknown to most employees of the power plant. The main office of the security department was located in a separate building of the plant's headquarters and was manned by approximately 10 officers and two master sergeants. The department chief was a lieutenant colonel. There were 15 guards assigned to Power Station No. 1 and 11 each in Power Stations Nos. 2, 3, and 4. Seven guards also were assigned to the Pumping Station and four each to Dams No. 1 and No. 2 and the water intake points. Equipped with pistols, submachine-guns, or rifles, the guards were responsible for the physical security of the power plant, surveillance of employees, and control of visitors. New assignments or transfer of employees had to be cleared in advance with the security department. To facilitate security, both ends of the dams were fenced with barbed wire, with a small gate. The top of each dam was equipped with booby traps of thin wire stretched seven centimeters high from the dam surface at intervals of about 15 meters. If anyone stepped on the stretched wire, a bell at the guard post by the dam rang immediately, indicating where the wire had been touched. At night, all interior lights were kept on at Power Stations No. 1 and No. 2 and half were kept on at Power Stations No. 3 and No. 4. Each of the penstocks for Power Stations No. 1 and No. 2 was illuminated by approximately 20 blinking floodlights of 500 watts each, and each of the

penstocks for Power Stations No. 3 and No. 4 with five floodlights of 500 watts each. Each power station was enclosed with a concrete or barbed wire fence; the more accessible points were equipped with four lines of uninsulated copper wire charged with 220-volt current. Contact would ring an emergency bell at the guard office of the power station. Because the power-charged wire was so dangerous, it was charged only during special holiday periods. While guards checked all visitors at the main gate of each power station, the employees of the power station did not have to show their passes. One or two guards patrolled the environs of the power stations once every two hours, day and night. At night, three guards were assigned to watch each surge tank. During holidays, surge tanks were guarded day and night, and many of the off-duty employees of the power plant were also put on guard duty inside the power station buildings. Passes, obtainable from the staff personnel department, with approval of the manager or the plant engineer, were required of all visitors. However, neighbors or family members of employees visiting the power station on private business were sometimes given access without a pass, although entry was subject to approval in advance. Many of the employees of the power plant were secretly working as informers for the security department, to which they submitted written oaths of secrecy. Their mission was to check on the idealogical tendencies of their fellow employees. They reported to a member of the guard office but seldom visited the security department headquarters. Among 31 employees of Power Station No. 4, at least five were known to have worked as informers of the security department.

Inspection Activities

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9. The Central Committee of the Korean Labor Party (KLP) made inspections [redacted]. The first inspection took about a month, the second about three months, and the third about nine months. The KLP Central Committee inspections concentrated on management of the plant and on personnel background and ideological attitudes. A mutual inspection system among enterprises subjected the Changjin-gang Power Plant to a quarterly inspection by five or six workers of the planning, accounting and technical sections, and by the Party committee of the Pujong-gang Hydroelectric Power Plant, who, for 15 to 20 days, examined planning, finance, material management, production accomplishment, technical standards, maintenance of equipment, working attitudes and discipline of employees, as well as trade union activities. The results of such an inspection were submitted in writing to the PIMB, which determined on this basis the winners of special prizes. There also were inspections by the Material Management Bureau of the PIMB and over-all inspections by the power plant management, in addition to production increase contest inspections, and techniques and skills inspections. The results were used for evaluating the performance and competence of each power station and workshop and their chiefs, and often caused a reevaluation of the grades of workers; sometimes the highest mark earners were given grade promotions.

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Functions

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10. [redacted] the Changjin-gang Hydroelectric Power Plant was a state-operated enterprise, Grade I, under the jurisdiction of the PIMB of the Heavy Industry Commission. The functions of selected personnel and departments of the power plant were as follows:

Manager: The manager was responsible to the PIMB for all administrative and production activities of the power plant and was assisted by the chief engineer and the deputy manager in technical and administrative matters, respectively.

Chief Engineer: The chief engineer was responsible for all technical matters of the power plant. Assisted by a responsible engineer, he supervised and controlled the technical, power supply, construction, hydraulic facilities, testing, and signal departments, the pumping and power stations, and the electric and machine workshop. The chief engineer acted in the absence of the manager.

Responsible Engineer: The responsible engineer guided technical aspects at the power plant in accordance with the instructions of the chief engineer and advised the chief engineer on technical problems. He could not act for the chief engineer during the latter's absence.

Power Station Chiefs: Each power station chief supervised the operation of his power station, with technical advice from the senior duty engineer, and handled the distribution of labor, supply of materials, and welfare of employees. He was consulted by the senior duty engineer on technical problems concerning the operation of the power station, but could not interfere with the decisions of the engineer on technical matters.

Senior Duty Engineers: The senior duty engineers, the technical supervisors of the power stations, controlled the operation of generators and control boards through duty engineers and directed the minor repair of cables and machines at the power stations through the repair workers' chiefs. The testing technicians, who were under the direct control of the senior duty engineers, performed various tests of machines and kept technical records. The senior duty engineers acted for the power station chiefs in the latter's absence.

Duty Engineers: The duty engineers operated the generators and control boards and maintained the surge tanks. Working in three eight-hour shifts, they controlled and supervised the operation of machines on instructions from the power supply commander. Their control over the operation of machines was never questioned by anyone except the senior duty engineer, who personally replaced any duty engineers whom he considered to be incompetent.

Planning Department: The planning department was charged with drawing up various plans for production, labor distribution, fund appropriation, supply of materials, and training of technicians. It was also charged with keeping statistics on the accomplishment of those plans. In addition, it analyzed the reasons for underfulfillment and practicability of plans, and in case it found the plans inpractical it negotiated with the PIMB for readjustment. Plans for power generation, consumption of power at the power plant, repair of equipment, production of machine parts, construction of various facilities, labor wages, procurement of materials, payment of travel expenses, prizes (or bonuses), repair expenses, increase or reduction of labor, and training of skilled workers and technicians were included.

Materials Department: The materials department received the allotment of materials from the Materials Management Bureau of the PIMB and transported the materials from the Central Materials Management Station or various production factories to the power plant, and thence to individual power stations. The department was also charged with transportation of all materials and equipment within the power plant area.

Testing Department: The testing department made technical tests, repairs, and adjustment of various gauges, relays, and such high voltage equipment as generators, transformers, disconnecting switches, oil circuit breakers, expansion circuit breakers, potential transformers, current transformers and others.

Signal Department: The signal department managed and repaired telephone equipment and was charged with the operation and management of a switchboard, equipped with approximately 20 Soviet [redacted] carrier telephone sets, which served as a central control point of the communication system for power distribution in North Korea. The switchboard was equipped with three or four circuits of local telephone lines connected to the Oro-up telephone switchboard, a number of security telephone lines connected to the Oro-gun Internal Affairs Station and the Hamgyong-namdo Internal Affairs Department, and a number of power supply telephone lines connected to the Central Power Supply Division of the PIMB and to various power plants and power transmission stations. This system enabled the Central Power Supply Division of the PIMB, by means of carrier telephones, to contact all power plants in eastern North Korea through the power plant switchboard. No restrictions were imposed on the use of telephones within the plant but outgoing telephone calls were subject to approval by the chief engineer.

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Hydraulic Facilities Department: The hydraulic facilities department was responsible for crutching work on such concrete structures as dam facilities, water intake structures, surge tanks, and power station buildings by periodically inspecting sinking and leaning rates as well as local damage to concrete structures. In addition, the department was responsible for new construction and major repairs on official residences of the power plant.

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Technical Department: The technical department was responsible for the technical affairs of the power plant, including the operation of Power Stations No. 1 through No. 5, the Pumping Station, Dams No. 1 and No. 2, as well as the water intake equipment. The electric instructors provided technical guidance on the handling of electric equipment and the machine instructors provided technical guidance on the operations of various machines. The hydraulic facility instructor inspected water conservation measures and the condition of hydraulic facilities.

Power Supply Department: The power supply department controlled generation, voltage, and transmission of power. It received instructions from the Central Power Supply Division of the PIMB, for transmission of power generated at the power plant, and relayed the instructions to various power plants on the North Korea eastern coast. The members of the department were divided into four teams, each consisting of a deputy commander and a worker who worked in three eight-hour shifts. A team was always reserved for holidays and to replace those on leave.

Electric and Machine Workshop: The electric and machine workshop repaired the electric and machine equipment and produced simple machine parts. Under the repair workers' chief were an electric repair team which repaired generators, transformers, potential transformers, current transformers, oil circuit breakers, and expansion circuit breakers, and a cable or wiring team which repaired power transmission cables, steel towers, and power distribution cables. The workshop, which also produced iron pipes, was equipped with about eight lathes, one shaper, one hobbing machine, one planer, two drilling machines, one bending roller, and forging equipment. The machine repair workers' chief, with two work teams, three crane operators, and three welders under his control, took care of major repairs of turbines, penstocks, and flood gate equipment. The operational workers' chief, with one clerk and five designers under his control, was responsible for the planning and guidance of work, supply of materials, distribution of labor, designing of machines, and accounting for costs of products turned out at the workshop.

Pumping Station: Dams No. 1 and No. 2 and the water intake points were controlled by the chief of the Pumping Station.

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11.

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ATTACHMENT TO

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ORGANIZATIONAL CHART OF

CHANGJIN-GANG HYDRO-ELECTRIC POWER PLANT

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MANAGER

ASSISTANT MANAGER

CHIEF ENGINEER

RESPONSIBLE ENGINEER

PLANNING DEPT
1 DEPT CHIEF
1 PRODUCTION PLANNER
1 BUDGET PLANNER
1 LABOR PLANNER
1 PRINTER

STAFF PERSONNEL DEPT
1 DEPT CHIEF
1 TRAINING INSTRUCTOR
1 STAFF MEMBER INSTRUCTOR

CLASSIFIED DOCUMENT OFC
1 CLASSIFIED DOCUMENT OFFICIAL

LABOR & WAGE DEPT
1 DEPT CHIEF
1 ASSISTANT CHIEF
2 COMPUTERS
2 LABOR EVALUATION INSTRUCTORS

MATERIAL DEPT
1 DEPT CHIEF
1 ASSISTANT CHIEF
1 CLERK
1 TRANSPORTATION INSTRUCTOR
5 ESCORTS
10 CARRIERS
7 DRIVERS
1 WAREHOUSE KEEPER
3 WAREHOUSE CLERKS
2 WAREHOUSE LABORERS
4 LABORERS

ACCOUNTING DEPT
1 DEPT CHIEF
1 ASSISTANT CHIEF
1 FOOD HANDLING CLERK(F)
1 COOPERATIVE INSTRUCTOR
11 RESIDENCE MANAGERS

BOOKKEEPING OFFICE
1 CHIEF BOOKKEEPER
1 ASSISTANT CHIEF
1 CASHIER
4 BOOKKEEPERS

TEST DEPT
1 DEPT CHIEF
1 RELAY TESTER
1 GUAGE TESTER
1 OIL TESTER
1 HIGH VOLTAGE TESTER
2 REPAIR MEN

SIGNAL DEPT
1 DEPT CHIEF
4 FOREMEN (WORKERS' CHIEFS)
7 TELE OPERATORS
4 CARRIER TELEPHONE WORKERS

HYDRAULIC FACILITIES DEPT
1 DEPT CHIEF
60 CONCRETE CRUTCHING WORKERS
4 SURVEYORS
3 DESIGNERS
40 RESIDENCE CONSTRUCTORS

CONSTRUCTION DEPT
1 DEPT CHIEF
4 DESIGNERS

TECHNICAL DEPT
1 DEPT CHIEF
2 ELEC INSTRUCTORS
2 MACHINE INSTRUCTORS
1 HYDRAULIC FACILITY INSTRUCTOR
2 STATISTICIANS

POWER SUPPLY DEPT
1 DEPT CHIEF(OR POWER SUPPLY COMMANDER)
4 DPTY COMMANDERS
4 WORKERS

PRODUCTION GUIDANCE DEPT
DETAILS UNKNOWN

ELECTRIC AND MACHINE WORKSHOP
1 CHIEF
1 ASST CHIEF

REPAIR WORKERS' CHIEF

ELECTRIC REPAIR TEAM
1 TEAM LEADER
45 WORKERS

CABLE (WIRING) TEAM
1 TEAM LEADER
15 WORKERS

(REPAIR) FACTORY WORKERS' CHIEF

SUB-TEAM NO. 1
NO. 2
NO. 3
3 SUB-TEAM LEADERS
25 LATHE OPERATORS
5 FINISHING WORKERS
3 SHAPER OPERATORS
3 HOBBING MACHINE OPERATORS
6 FORGING WORKERS
4 WELDERS

MACHINE REPAIR WORKERS' CHIEF

TEAM NO. 1
NO. 2
2 TEAM LEADERS
40 WORKERS

CRANE OPERATORS 3

WELDERS 2

OPERATIONAL WORKERS' CHIEF
1 CLERK
5 DESIGNERS

POWER STATION NO. 1 55

1 CLERK
1 LABORER
1 COOK

CHIEF 1

SENIOR DUTY ENGINEER 1

DUTY ENGINEER (4) 4

TESTING MAN 1

REPAIR WORKERS' CHIEF 1

CONTROL BOARD WORKERS 16

MACHINE ROOM (GENERATOR OPRS) 18

SURGE TANK WORKERS 4

ELEC REPAIR WORKERS 4

MACHINE REPAIR WORKERS 4

POWER STATION NO. 2 57

SUBORDINATE ORGN WAS IDENTICAL TO THAT OF POWER STATION NO. 1 EXCEPT NR OF WORKERS.

16
16
4
5
5

POWER STATION NO. 3 31

SUBORDINATE ORGN WAS IDENTICAL TO THAT OF POWER STATION NO. 1 EXCEPT NR OF WORKERS.

8
8
0
2
2

POWER STATION NO. 4 31

SUBORDINATE ORGN WAS IDENTICAL TO THAT OF POWER STATION NO. 1 EXCEPT NR OF WORKERS.

8
8
0
2
2

POWER STATION NO. 5 23

CHIEF 1

1 CLERK
1 COOK

DUTY ENGINEER 1

FOREMEN (4) (WORKERS' CHIEF) 4

CONTROL BOARD WORKERS 4

MACHINE ROOM WORKERS 6

REPAIR TEAM CHIEF 1

ELEC REPAIR MAN 1

MACHINE REPAIR MAN 1

PUMPING STATION 35

SUBORDINATE ORGN WAS IDENTICAL TO THAT OF POWER STATION NO. 5 EXCEPT 4 LABORERS EACH OF DAM NO. 1, DAM NO. 2 & WATER INTAKE.

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